

exercised in this College in its earlier years as a skilful pilot guiding the ship till it was well out of port. His high ideal of the function it should discharge in the education of the country and the practical zeal and ability which he ever brought to bear on the administration of our affairs contributed in no small measure to place the College in the assured position it occupies to-day.

On his great physical and chemical investigations it is happily the less necessary for me to touch, as they have been so fully brought before you by our President in his opening Address; and as regards the most important of these researches, those on the continuity of the Liquid and Gaseous states, no one assuredly could have more fitly expounded them than one who has himself pressed forward with such splendid success in the paths which Andrews opened up.

I have always considered that Andrews, through the long course of these later researches, was most fortunate in having near at hand such a friend as James Thomson; not that he was a collaborator—for Andrews did all this work unaided—but that Thomson gave him throughout that best of all encouragement which consists in enlightened appreciation of the importance of the results he was obtaining and of their inner meaning and significance.

Of Thomson himself what shall I say? Of all the scientific men I have come across he perhaps most fulfilled the idea of a philosopher, his ever-working brain ever seeking out causes, ever pondering on the why and the wherefore of the unexplained.

One of his earliest investigations is perhaps the best known, that in which, basing his reasoning on Carnot's principle, he demonstrates the effect of pressure in lowering the freezing-point of water, and in which he gave at the same time a numerical estimate to this effect.

This discovery was of great practical import, for, small as the effect was, it enabled him to explain fully the rationale of the plasticity of ice.

Forbes had already shown that the motion of glaciers depended upon a plastic or viscous quality in the ice. It remained for Thomson, by the aid of his newly discovered principle, to go a step further and account for this plasticity.

It is interesting to note that the questions which led to some of his most valuable investigations seem to have been started by the filial task he took upon himself of re-editing his father's educational text-books. It was, for example, the revision of a chapter in his father's Geography which I believe led him to examine more thoroughly into Hadley's theory of the Trade winds, and to make the following important addition to that theory. He showed that while in the tropical latitudes, say of our northern hemisphere, two currents would satisfy all the conditions, *i.e.*, the Trade wind blowing from N.E. to S.W. in the lower regions of the atmosphere, and the return current in the upper regions, on the other hand that in the temperate latitudes there must be three currents at different elevations; that the uppermost and the lowest of these have a movement towards the Pole, but in the middle regions of the atmosphere between these there must be a large return current from the Pole, and that the prevailing motions of all three currents would be from west to east.

Thomson was particularly successful in his treatment of this and other questions of fluid motion. He was not familiar with the technique of the higher mathematics, and on this very account was not tempted, as so many mathematical experts are, to assume impossible conditions in order to bring the problems within reach of their algebraic analysis; but for all that his mind was eminently of a mathematical cast. He is never vague or loose in his reasoning, and he had a wonderfully tenacious grasp of physical principles. The result was that he has succeeded in finding out the key to some of the most curious phenomena in the motions of fluids.

I may give as a typical instance of his line of reasoning his beautiful explanation of the action of the water of a river flowing round a bend. He saw clearly that from true dynamical principles the flow of the water must be most rapid near the inner bank, and the question which presented itself to his mind was why then the inner bank was not worn away. The answer he showed to consist in the friction of the bed checking the velocity of the lowest stratum of the water. The effect of this he proves to be that an under-current is produced in this stratum across the bed of the river from the outer towards the inner bank, a current which does two things: it carries sand and

detritus and deposits them on the inner bank; and, since the water in this current has to rise vertically to the surface when it reaches this bank, it thus protects it from the scour.

In a review of Thomson's work we should emphasise his constant endeavour, whether in Mathematics or Physics, to attain clear conceptions of fundamental principles. This showed itself in the various innovations in nomenclature he introduced. Many of the new words he coined, "radian," "numeric," "torque," "interface," "clinure," "posure," &c., are great helps both in thinking and teaching.

The same determination at any cost of hard thinking to arrive at clearness in regard to fundamental principles is strikingly evidenced by one of his later papers, that on the "Law of Inertia and the Principle of Chronometry," which is a most searching discussion of the true significance of Newton's first and second laws of motion.

I must now close this review. I shall be glad if I have succeeded, however imperfectly, in giving you some impression of our Irish schools of Mathematics and Physics, of the workers and of the sources from which they drew their inspiration. There surely never was a time when the problems presented to the mathematician by Physical Science were more interesting; never a time when Science for its onward progress stood more in need of those gifted ones who combine clearness of thought with imagination and hopeful courage. Let us hope that amongst these in this new century, others of our countrymen may be found not unworthy to have their names inscribed in the roll which contains those of Hamilton and MacCullagh, of Andrews and Thomson.

#### NOTES.

WE record, with very deep regret, the death of Prof. Virchow, on September 5, in his eighty-first year. The State funeral accorded to Prof. Virchow took place in Berlin on Tuesday. Among those present were the Prussian Ministers of Education and Finance, the Foreign Secretary, the Chief Burgomaster of Berlin, and numerous representatives of Berlin and other universities, and of learned and scientific societies—both German and foreign. After the funeral service, orations were delivered, in which Prof. Virchow was considered as man of science, politician and municipal reformer. At the meeting of the Paris Academy of Sciences on Monday, a eulogy on Prof. Virchow was delivered by M. Bouchard.

WE have also to announce the death of Sir Frederic Abel, on September 6, in his seventy-sixth year.

THE next meeting of the Australasian Association is to be held in Dunedin, New Zealand, in January, 1904, and the following have been appointed presidents of sections:—B—Chemistry: J. Brownlie Henderson, Brisbane. C—Geology and mineralogy: W. H. Twelvetees, Hobart. D—Biology: Colonel W. V. Legge, R.A., Hobart. E—Geography: Prof. J. W. Gregory, Melbourne. F—Anthropology and philology: A. W. Howitt, Melbourne. G—Economics, subsection 2, agriculture: J. D. Towar, Roseworthy, South Australia. H—Architecture, engineering and mining: H. Deane, Sydney. I—Sanitary science and hygiene: Dr. Frank Tidswell, Sydney. J—Mental science and education: John Shirley, Brisbane.

THE annual congress of the Sanitary Institute was opened at Manchester on Tuesday last, when some two thousand delegates were present from all parts of the country.

IN connection with the celebration of the 100th anniversary of the birth of Niels Henrik Abel, now in progress at Christiania, twenty-nine foreign men of science on Saturday last received the degree of Doctor, *Honoris Causa*; among the number were Lord Kelvin, Lord Rayleigh, Sir George Stokes, Prof. G. H. Darwin, Prof. Forsyth, and the Rev. George Salmon, Provost of Trinity College, Dublin.

THE Punjab Government has, according to the special Indian correspondents of the *Lancet* and the *British Medical Journal*,

submitted a great project to the Government of India and the Secretary of State for sanction in order to grapple with the expected outbreak of plague during the coming winter. The disease has rapidly grown in intensity in the province. Commencing in 1899-1900 with two districts and one native State affected and 530 deaths, followed by the next year with seven districts and two native States affected and 6399 deaths, it had last year no less than twenty-three districts and nine native States attacked and more than 200,000 deaths. Experience has shown that segregation of the sick is out of the question, that evacuation of dwellings even in villages can only be partial, and that disinfection is practically useless. This being so, the Punjab Government now proposes to offer universal voluntary inoculation. Arrangements are to be made to perform six and a half million inoculations between now and January next. The scheme is expected to cost more than Rs. 8 lakhs.

INFORMATION has been received through Reuter's Agency concerning the progress which has been made by the commission sent out to inquire into the mysterious "sleeping sickness" of Uganda. The three members of the commission—Drs. Low, Christy and Castellani—arrived in Uganda on July 10. Drs. Castellani and Low proceeded direct to the Government headquarters at Entebbe, where they arrived on July 12, but Dr. Christy, at the request of the Sub-Commissioner, made a detour in order to proceed by land through Busoga, where the disease is very severe. Dr. Christy arrived at Entebbe on July 27, and intended leaving in a few days for Buddu, on the west shore of the lake. Everything is being done by the authorities to assist the doctors in their investigations, and the Commissioner has ordered the erection of a laboratory at Entebbe. All the scientific apparatus has reached Uganda in good condition. A complete "sleeping sickness" hospital has been prepared, and on July 29 there were ten cases under close study, three *post mortem* examinations having also been obtained. Dr. Castellani had then got all his *media* prepared and the laboratory in order for complete bacteriological examination. Dr. Low has examined the blood of about 600 individuals, with interesting results.

AN International Fishery Exhibition, the first ever held in Austria, was opened on Saturday last in Vienna by the Archduke Franz Ferdinand. The exhibitors are mainly Germans, but France, Italy, Norway and Roumania are represented. England is taking no part in the exhibition.

ACCORDING to the *Athenaeum*, the committee of the fund which was formed in honour of the eightieth birthday of Prof. Virchow has now ended its work, and reports that it has collected 53,652 marks. This, added to the subscriptions to the fund from other sources, will put the Virchow Stiftung in the possession of a sum of nearly 150,000 marks. The yearly interest of the fund was to have been expended on scientific objects specially indicated by Prof. Virchow.

MR. SANTOS DUMONT'S new balloon, the construction of which has been begun, will be 25 metres long by 11 metres in diameter, and will carry two aeronauts and eight passengers.

A REUTER telegram from Budapest states that the electric railway, about 100 kilometres in length, along the shore of Lake Como was opened on September 4. The electrical power, amounting to 20,000 volts, is obtained from the Falls of the Adda. At the stations, the current is reduced to 3000 volts and transmitted through overhead contact wires. The power derived from this source will also be applied shortly to working the motors and electric carriages on the Lecco-Colico line. The new work, which is supplied with a full high-tension electrical system, has been carried out in accordance with the Kando system.

MR. GREGG WILSON has been appointed by the President of the Board of Trade an inspector of fisheries in England and Wales, in succession to Mr. Henry Noel Malan.

A DESPATCH from Carupano, Venezuela, to the *Figaro* states that violent detonations were heard there between ten o'clock on the night of September 3 and four o'clock on the following morning. They came from the north and were identical in character with those which were heard on the night of August 30 during the eruption of Mont Pelée. A message from the St. Thomas correspondent of the *Times*, sent on September 7, states that a slight eruption of the St. Vincent Soufrière took place at noon on September 3, and the inhabitants left Georgetown and Château Belair. At ten o'clock at night there were loud thundering noises and electrical discharges from the volcano, while from one o'clock until four o'clock in the morning there was a continuous roar. Afterwards there were murmurings for two hours. On the morning of September 4 the sky was obscured by dust and smoke, and the scene is described as terrible. Pebbles and dust fell at Barrouallie, and at Château Belair there was a heavy fall of sand. A telegram from Paris on September 7 states that the French Colonial Office has directed M. Lacroix, the head of the scientific mission which was sent to Martinique, to organise the permanent station of operations which is to be established there, and M. Lacroix will start as soon as he has collected the necessary apparatus.

AN earthquake of six seconds' duration was experienced at Pau (Pyrenees) at 2.30 on the morning of September 8.

THE Athens correspondent of the *Times* has called attention to some very destructive forest fires which have recently taken place in Greece, due mainly, it is said, to human agency. In some cases the woods are deliberately set on fire by the peasants for the purpose of making clearances for arable land, or by the shepherds in order to increase the extent of pasturage; in other cases, conflicts between neighbouring communes over the right of cutting timber have led to wanton acts of incendiarism, while lighted matches or cigarettes thrown carelessly into the thickets or sparks from the fires in the shepherds' cantonments are often productive of widespread destruction. As our contemporary remarks, these calamities demand the serious attention of the Greek Government, the loss to the country being very great. Although in recent years the matter has attracted some notice, not much has been done to remedy the evil. True, a society for the reforestation of the country has been formed, but it is doubtful whether any great success will be attained by voluntary agencies. The matter of the protection of the national forests rests with the Greek Government, which does not appear to be fully alive to the serious condition of things.

THE August issue of the *Elektrochemische Zeitschrift* contains an article by Th. Gross which seems to suggest that silicon is not an element. The author has been investigating the behaviour of silica when exposed to long-continued electrolysis, and in his opinion has proved that some second element is present in the resulting fused mixture. Starting with 15 grams of pure silica, and using 30 grams of pure caustic potash as solvent, an electric current was led through the molten mass for some hours, and the unaltered silica was then removed from the product by the usual chemical methods. The experiment was carried out in a silver crucible. The silica recovered showed a deficiency on the original weight, and the balance was found in 2.8 grams of a substance possessing different physical and chemical properties. This substance was easily soluble in hydrochloric acid. When heated in a porcelain crucible, it melted and yielded a brown mass, which, on treatment with



hydrogen gas, left a grey residue possessing metallic characteristics resembling those of selenium. The experiments, however, require confirmation before the conclusion can be accepted.

THE last number of the *Journal* of the Institution of Electrical Engineers contains chiefly papers read before the various local sections. These show that the policy of the Institution in establishing these sections was a very wise one, the papers being quite equal in merit, if not superior, to those read in London. Mr. Osborne's paper on the lighting and driving of textile mills by electricity, read at Dublin, will be read, we feel sure, with great interest; it shows that the electrical engineer has still a great deal to study with reference to the best kind of light, and its proper distribution, for special purposes. Another paper dealing with a subject of great importance at the present time is that by Mr. Clothier on switch-gears, which is to be specially commended for its very beautiful illustrations. The Institution's *Journal* has shown a very marked improvement in this respect during the past few years; the illustrations published two or three years ago are not to be compared with those which now appear in it.

ACCORDING to the *Scientific American*, the new Marconi Transatlantic signalling station at Cape Breton is nearly completed, and will be ready for commercial working in the course of a few weeks. We reproduce an illustration showing the

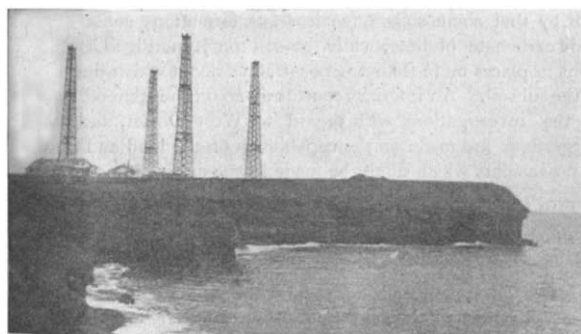


FIG. 1.—The New Marconi Wireless Telegraph Station at Glace Bay, Cape Breton.

general appearance of the station, with its low buildings containing the signalling plant and its four wooden towers for supporting the aerial conductor. These towers are more than 200 feet high (their tops being about 300 feet above sea-level), and are placed at the corners of a 200-foot square. From the top platform of each tower to that of its neighbour is strung a horizontal cable from which the vertical conductors depend; these, 150 in number, are all joined together in the centre of the square, thus forming an inverted pyramid from the apex of which a single cable runs into the apparatus room. The wooden towers are of special design and are well stayed with wire ropes to prevent them from being blown down in a gale. The machinery installed is stated to be more powerful than is necessary for merely signalling to Europe, and hopes are entertained of transmitting messages to Cape Town. As a receiver, the coherer has been discarded and a more trustworthy instrument substituted; this is in all probability the magnetic receiver recently described by Mr. Marconi before the Royal Society.

IN the *Century* for September, Mr. R. T. Hill and Prof. I. C. Russell contribute articles on the West Indian volcanic eruptions, both of which are excellently illustrated with pictures, many of which are published for the first time. Although the text of these articles to a great extent describes observations

similar to those with which we are already familiar, here and there, as, for example, in Mr. Hill's description of one of Pelée's eruptions which he witnessed, we find materials well worth the attention of students of volcanic phenomena. Since the articles were written, on the night of August 30, Mont Pelée and the Soufrière in St. Vincent have broken out again, and this time with exceptional intensity. Morne Rouge has disappeared, and there is "not a single creature left to tell the tale." More than a thousand persons are reported to have lost their lives. Carbet was invaded by a sea wave, a portion of the island sinking in the sea; at Fort de France the sea penetrated 40 feet inland, and the water line at that place has risen 5 to 6 feet. These disturbances in the ocean may result from a movement in its bed, which, considering the number of cables which have been interrupted, appears likely, or they may be directly due to the hurricane-like blasts from the mountain. In this last eruption, we again appear to have evidence of a connection between seismic and volcanic activities. The hour at which Mont Pelée and the Soufrière renewed their violence is not known, but on August 30, at 9.59 p.m. (5.54 p.m. St. Vincent's time), an earthquake occurred at a distance of about 62° from the Isle of Wight, which probably disturbed the whole of our globe. If this can be identified with a violent earthquake which at 9 p.m. disturbed Venezuela on that date, we again have a repetition of a history common to all the known West Indian eruptions. The gratuitous prophecies that Martinique is to sink beneath the ocean again appearing in papers are only increasing alarm, depreciating the value of property and giving trouble, not only to the authorities in Martinique, but to the governors in adjacent islands. Although the inhabitants of districts which are threatened are being moved to places of safety, the alarm at the possibility of further devastation is intense. Let this be increased by sensational announcements and there may be panic, the results of which can only intensify calamity.

WE have received from M. Henri Desmarest a copy of his article on "La Houille blanche," which appeared in the *Revue Universelle*. The paper describes in a popular manner the utilisation of water power for industrial purposes, and the author points out that France, having at command a large supply of waterfalls, may hope, by making the most of its advantages, to take a leading place amongst the nations. A table shows that more than 500,000 h.p. is already utilised, but this is only one-twentieth of the power available. The article is copiously illustrated by photographs of waterfalls and turbines, and diagrams showing the general construction of water-power installations; there is also an interesting little map of France, shaded to show the amount of power existing in the different departments. One of the photographs shows the motor erected at Santa Cruz for using the power of the sea waves; this consists of two wells sunk near the sea front, in one of which is a float which is raised and lowered by the waves; the float is connected to, and works, a pump in the second well, which forces the sea-water into a reservoir, from which it can be drawn when required.

A NOTE on the use of Fourier's series in the problem of the transverse vibrations of stretched strings is contributed by Dr. H. S. Carslaw to the current number of the *Proceedings* of the Edinburgh Mathematical Society. Dr. Carslaw proves that where the initial form of the string involves discontinuity in the slope of the curve, the  $n$ th term of the series for the displacement is at most of order  $1/n^2$ , and the series cannot, therefore, be differentiated twice term by term, as would be necessary if the series is to be proved to satisfy the differential equation of vibration. Where, however, no discontinuity occurs in the slope of the string, the  $n$ th term of the series is of order  $1/n^3$ , and the second differentiation term by term is possible. But then, as

Dr. Carslaw remarks, the equation of vibration of a stretched string is obtained on the assumption that no such discontinuities occur; if sharp corners exist, dynamical difficulties are introduced.

THE French Physical Society has undertaken the publication of a collection of elementary physical experiments. This book will describe class experiments, and also simple experiments of a suitable character for class exercises. The first part, dealing with geometry, mechanics, gravity, hydrostatics and heat, is now in preparation.

SOME statistics as to the use of alcohol as an illuminant are given by M. L. Denayrouze in the *Bulletin* of the French Physical Society, No. 185. This use of alcohol, first proposed in Germany a few years ago, has recently been rendered practicable from a commercial point of view by the introduction into France of methylated spirits, and also by an increase in the efficiency of the Denayrouze lamp. Taking 1.08 grams of pure alcohol or 0.64 gram of carburetted alcohol (alcohol carburé) per candle hour as the consumption of this lamp, the cost is estimated at 0.00478 and 0.00298 of a penny per candle hour for these two alcohols, as against 0.01428 of a penny for petroleum. The lamp consists essentially of a wick, conducting the liquid by capillarity into a chamber where it is vaporised, the necessary heat being produced by a copper bar which derives its heat from the lamp itself. The vapour passes through a small channel into a kind of Bunsen burner, above which the mantle is fixed. The series of operations is entirely automatic.

THE *Ceylon Independent* of August 11 contains Prof. Herdman's report on the pearl fisheries in the Gulf of Manaar. The objects of the professor's investigations were fourfold. Firstly, to inspect the oyster banks; secondly, to find out the conditions under which the molluscs live; thirdly, to take into consideration the marine zoology of the other Singalese waters in connection with trawling; and, lastly, to select a spot for a marine laboratory. As the result of the survey, it was found that in the main the oysters were healthy and free from epidemic, and, indeed, from much disease of any description. Parasites were present in considerable numbers, but were not considered to be doing much damage. "Spat" were found in abundance in certain localities, and enormous quantities of young oysters in others. A large percentage of these appeared, however, never to reach maturity, either from being destroyed by enemies, choked in sand or overcrowded. The remedy for this is thinning out and transplanting. It is concluded that "there is no reason for despondency in regard to the future of the pearl-oyster fisheries, if they are treated scientifically."

Two papers of considerable interest on fossil mammals are to hand. In the one—issued by the Cairo Survey Department—Messrs. Andrews and Beadnell describe remains of new forms from the Eocene of Egypt, among which the lower jaw on which the genus *Phiomia* is based is perhaps the most interesting and remarkable. The other—published in the *Journal* of the College of Science of Tokio—relates to part of a skull from the Tertiary of Japan believed by its describers, Messrs. Yoshiwara and Iwasaki, to indicate a new type of proboscidean.

In vol. ii. pt. 10 of the *Annals* of the South African Museum, Sir George Hampson continues his valuable catalogue of the moths of South Africa, describing many new genera and species.

THE Museums Association has issued the first volume of its *Journal*, edited by Mr. E. Howarth, and containing an excellent portrait of Sir William Turner. The volume will be welcome to all interested in museum improvement, whether from the general education standpoint or on more strictly scientific grounds.

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THREE memoirs of the Geological Survey of England and Wales have recently been issued in explanation of the one-inch maps. That on Ringwood, by Mr. Clement Reid, is accompanied by a colour-printed map which has been admirably executed by the Ordnance Survey. The area described is a part of the Hampshire Basin, and attention is drawn to the evidence of an old river course, which probably in Newer Pliocene times connected the Salisbury rivers with Southampton, before they were captured and diverted along the course of the subsequent Lower Avon. The geology of Southampton, also by Mr. Reid, with contributions by Mr. Whitaker, gives a concise account of the Chalk and Tertiary strata, and of the Pleistocene deposits some of which yield Palæolithic implements. Several new inliers of London Clay have been recognised, and these indicate an extension to the westward of the Portsdown anticline. The geology of the country around Exeter is by Mr. W. A. E. Ussher, and it gives a fairly full account of the Culm-measures, the various divisions of the New Red Sandstone series, and the superficial deposits. Much interest attaches to the volcanic rocks, which are probably of Permian age, and the field-observations are supplemented by petrological notes by Mr. Teall.

A THIRD report on the soils of Dorset, by Mr. D. A. Gilchrist and Mr. C. M. Luxmoore, has been issued by University College, Reading (1902). Attention is directed to the amount of carbonate of lime in the fine earth of various soils, and it is noteworthy that some soils on calcareous formations contain very little carbonate of lime, while the soil on Kimeridge Clay contains in places more than 2 per cent., an amount which decreases in the subsoil. An interim report is given on the general results of the investigations with regard to West Dorset, and many suggestions are made on the capabilities of the land and on the improvements which might be made in the cultivation of it.

THE *Chemical News* for September 5 is a "Students' Number," and contains much useful information respecting the leading schools of chemistry in the country.

THE additions to the Zoological Society's Gardens during the past week include a Campbell's Monkey (*Cercopithecus campbelli*) from the West Coast of Africa; a Bosman's Potto (*Perodicticus potto*) from West Africa, presented by Mr. G. Robertson; a Rhesus Monkey (*Macacus rhesus*) from India, presented by Dr. Bates; a Green Monkey (*Cercopithecus callitrichus*) from West Africa, a Two-spotted Paradoxure (*Nandinia binotata*), a Dorsal Hyrax (*Hyrax dorsalis*) from the Gold Coast, presented by Mr. A. W. Morris; two Suricates (*Suricata tetradactyla*) from South Africa, presented by Capt. C. F. Wanhill, R.A.M.C.; a Suricate (*Suricata tetradactyla*) from South Africa, presented by Colonel J. S. Ewart; two Naked-footed Owlets (*Athene roctua*) European, presented by Mr. A. J. Challis; fourteen Wall Lizards (*Lacerta muralis*) European, presented by Dr. Lewis H. Gough; two Madras Entellus Monkeys (*Semnopithecus priamus*), new to collection, from Southern India; a Pale Genet (*Genetta senegalensis*) from the White Nile; four Blue Lizards (*Gerrhonotus coeruleus*) from Western North America, deposited.

#### OUR ASTRONOMICAL COLUMN.

OBSERVATIONS OF VARIABLE STARS OF LONG PERIOD.—Writing in the *Observatory* for September, Prof. Pickering gives an abstract of an earlier paper on the really valuable work that might be done by willing observers who only possess small instruments. He states that the number of telescopes of small size (*i.e.* 10 to 30 cm. aperture) now in use, is out of all proportion to the meagre results obtained by their aid, and suggests that observations of long-period variables by Argelander's method would, if systematically made, prove of real value in furthering our knowledge of these objects.